

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION
Fact Sheet No. 4 For Dairies

Nutrient and Irrigation Water Management Plans

Question: What is a Nutrient and Irrigation Water Management Plan (NIWMP)?

Answer: A NIWMP is a written description of the procedures used to select and apply crop nutrients (manure and commercial fertilizers) and water to cropland, including pasture. The NIWMP includes a description of the process used to determine **how much** manure and commercial fertilizer is needed by the crops and a description of **when and how** nutrients and irrigation water (including wastewater) are applied. Although a NIWMP can be used in any farming operation, the following information specifically applies to dairies where manure and wastewater are applied to cropland.

Question: Why is a NIWMP prepared?

Answer: A NIWMP is used to ensure that crops receive an optimum amount of nutrients and water. If insufficient nutrients are applied, crop yields will be reduced. If excessive nutrients are applied, or if improper irrigation practices are utilized, adverse environmental impacts can result from nutrients entering surface or groundwater. In addition, over fertilization can reduce crop yields and is a waste of valuable resources (fertilizer purchases can be reduced and excess manure can be sold or used elsewhere).

Question: When should a NIWMP be prepared?

Answer: A NIWMP is *required* for confined animal feeding operations in the Central Valley Region of California if the facility has general waste discharge requirements issued by the Regional Water Quality Control Board (Board). A NIWMP may also be required by the Board as part of a Cleanup and Abatement Order or other enforcement action or by a county regulatory agency. However, a NIWMP is *recommended* for all confined animal-feeding operations because it will help to optimize crop yields and protect the environment.

Question: Who prepares the NIWMP?

Answer: A NIWMP can be prepared by any person who understands crop nutrient and water requirements, has information on the properties of animal wastes, and has the essential site-specific information for the facility for which the NIWMP is being prepared. The site-specific information that is needed includes information on the waste management practices and the farming operations and generally must be obtained from the person(s) who manage the confined animal feeding operation and the cropland.

Question: What format is used for the NIWMP?

Answer: The Dairy Farm Advisors at the University of California Extension Service are developing a guidance document for preparation of a NIWMP. The guidance document should help anyone preparing a NIWMP by identifying essential information, providing generally accepted values, and presenting a logical format to follow. However, until the guidance document is available, there is no “standard” format to follow. Therefore, anyone required to prepare a NIWMP must develop their own format for a NIWMP. The following information is provided by staff in the Board’s Sacramento office to assist dairy operator’s who must prepare a NIWMP before the Extension Service’s guidance document becomes available.

Tables 1 and 2 can be used to estimate the amount of nitrogen available to crops from manure produced at a dairy. Table 1 is used to calculate the Animal Units (1,000 lbs each) at the dairy. Table 2 is used to estimate the nitrogen loading if the manure is applied to cropland. An alternate and superior way to evaluate the nitrogen loading is to have the holding pond contents and manure stockpiles analyzed periodically and to then use the reported nutrient values along with the wastewater and manure application rates to determine the nutrient-loading rate.

TABLE 1: CALCULATION OF ANIMAL UNITS (AU)

			A.	B.	C.	D.	E.	F.
	ANIMAL	Factor	Freestalls		Flushed Corrals		Scraped Corrals	
			Head	AU ¹	Head	AU ¹	Head	AU ¹
1.	Milk Cows	1.0						
2.	Dry Cows	0.8						
3.	Heifers (2 years and older)	0.73						
4.	Heifers (1 year to breeding)	0.73						
5.	Calves (3 months to 1 year)	0.35						
6.	Baby Calves (< 3 months)	0.21						
7.	Subtotals							

TOTAL AU	
Value From	
B.7	
D.7	
F.7	
TOTAL	

Adjustments for Animal Breed: The AU values above are based on 1,000 pound AU per Title 40 Code of Federal Regulations, Section 122, and can be used directly for Jersey cows. For Guernseys, multiply the Milk Cow and AU values by 1.2 before using them in Table 2; for Holsteins, multiply the Milk Cow and AU values by 1.4 before using them in Table 2

TABLE 2: CALCULATION OF NITROGEN LOADING ²

Value from Table 1 ⁽³⁾	Liquid Waste Factor	Liquid Waste Nitrogen	Solid Waste Factor	Solid Waste Nitrogen
B.7	x 0.8 x 0.45 x 0.25 x 365			
B.1	x 0.8 x 0.11 x 0.25 x 365			
B.7			x 0.2 x 0.45 x 0.25 x 365	
B.1			x 0.2 x 0.11 x 0.25 x 365	
D.7	x 0.6 x 0.45 x 0.25 x 365			
D.1	x 0.6 x 0.11 x 0.25 x 365			
D.7			x 0.4 x 0.45 x 0.25 x 365	
D.1			x 0.4 x 0.11 x 0.25 x 365	
F.1	x 0.1 x 0.56 x 0.25 x 365			
F.1			x 0.9 x 0.56 x 0.25 x 365	
F.7-F.1			x 1.0 x 0.45 x 0.25 x 365	
Subtotal				
Increase if wastewater is stored less than 30 days		x 2.0		
TOTALS (pounds of N)				

The total pounds of nitrogen as calculated above are the total amount available to crops where the wastewater and solid manure is applied. If solid manure is hauled off-site or wastewater is applied to adjacent property, an adjusted value for available nitrogen should be considered relative to crop needs at the dairy. Information on calculating crop nitrogen need is presented on the following page.

¹ Animal Units (AU) are calculated by multiplying the number of Head by the appropriate factor.

² The following assumptions used in calculating nitrogen values are consistent with assumptions used by staff in Merced County: The animals are housed for 365 days/year; the nitrogen excretion rate is 0.56 lbs./Animal Unit/day for milk cows and 0.45 lbs./Animal Unit/day for other cows; 80% and 60% of the manure in freestalls and flushed corrals, respectively, is handled as a liquid. For milk cows in dry corrals or where alleys are scraped, 10% of the manure is in washwater at the milk barn. When wastewater held less than 30 days is applied to cropland there is a 50% loss of nitrogen loss, and when wastewater held more than 60 days is applied to cropland, there is a 75% loss of nitrogen. There is a 75% loss of nitrogen from storage and application of dry manure. These values are based on various studies and reports; however, the values may be modified in the future as new information becomes available.

³ For Guernseys and Holsteins, use adjusted values.

The following table can be used to identify the nitrogen needs of specific crops. The nitrogen requirement values are primarily taken from the Western Fertilizer Handbook (8th Edition, 1995) that also lists other crops and nutrients in addition to nitrogen. The county Farm Advisor may be able to provide requirements for specific crop varieties.

TABLE 3: NITROGEN REQUIREMENTS FOR CERTAIN CROPS

CROP	YIELD (tons)	LBS. N PER ACRE	CROP	YIELD (tons)	LBS. N PER ACRE
Alfalfa	8	480	Oats	1.6	115
Almonds	1.5	200	Orchardgrass	6	300
Barley	2.5	160	Prunes	15	90
Bermudagrass	4	225	Safflower	2	200
Bromegrass	5	220	Sorghum-sudan	8	325
Clover-grass	6	300	Sugar Beets	30	255
Corn (grain)	5	240	Tomatoes	30	180
Corn (silage)	30	250	Timothy	4	150
Cotton (lint)	0.75	180	Vetch	7	390
Grain sorghum	4	250	Wheat	3	175

Using information obtained from Table 3 or other sources, the nitrogen requirements for cropland at a dairy can be calculated as shown in Table 4.

TABLE 4: CROPLAND NITROGEN REQUIREMENTS

Field Number or Name	Nitrogen Needs (lbs. N/acre) ⁴				Field Acres	Total lbs. N per Field (Field Acres x Total N)
	First Crop	Second Crop	Third Crop	Total N		
Total Acres →						
						↑Total N (lbs./year)↑

Evaluation of Nutrient Requirements: Using the total pounds of nitrogen available value from Table 2 and the total nitrogen requirement value from Table 4, an initial determination can be made as to the relationship between nitrogen availability and nitrogen need and whether or not it is necessary to export manure or to import fertilizer. As with any farming operation, periodic measurements of nitrogen in cropland and/or crops should be made in order to better determine nutrient requirements for optimum yield.

Developing the Nutrient and Irrigation Water Management Plan: A summary of the nitrogen availability and nitrogen need values and of the decision on exporting manure or importing fertilizer is the basis for the nutrient management plan. Although nitrogen is usually the nutrient of concern at confined animal facilities because of the potential for impacts to water quality, other nutrients should also be considered. Other information that may be included in the nutrient management plan includes a determination of the cropland characteristics and a description of when and how the manure and wastewater will be applied to cropland. The information on *when* can be presented in relation to crop planting and growth. The information on *how* can be related to the Water Pollution Prevention Plan, Stormwater Management Plan, or other document(s) related to waste and water management.

The relationship of cropland characteristics to irrigation water management should be considered when developing a NIWMP. The cropland characteristics that should be addressed in the NIWMP include the depth to groundwater, soil type(s), field dimensions and topography, irrigation method(s), drainage controls, and annual rainfall patterns.

Careful management of irrigation water is necessary to ensure that nutrients are applied to cropland at the desired rate and that adverse impacts to the environment are minimized. Proper irrigation results in even application of nutrients to cropland and prevents excessive percolation and runoff that can, respectively, result in adverse impacts to groundwater and surface water.

⁴ From Table 3 or equivalent source. May be adjusted for crop yield.

The Irrigation Water Management component of a NIWMP is a written description of procedures that are followed for proper irrigation, and should address the following topics:

- Procedures that are used to mix wastewater and "clean" irrigation water
- The irrigation system used to apply wastewater to cropland
- The methods used to determine and control the rate of application
- Procedures followed to determine when sufficient water has been applied
- Physical and management controls used to prevent tailwater containing manure from moving off of the dairy
- Controls that will be used if it becomes necessary to apply wastewater to land during the rainy season
- Procedures used to prevent irrigation with wastewater from creating nuisance conditions.

In addition, the NIWMP should contain figures that show the location of cropland where manure and wastewater is applied. The figures should show nearby water courses and ditches, the slope of irrigated lands, the location of wells and pumps, and points from which tailwater can be discharged. If wastewater is applied to property under different ownership than the dairy, a copy of agreements on the application of wastewater to the property should be included.

Additional information related to the preparation of Nutrient and Irrigation Water Management Plans is available in the "Environmental Stewardship Short Course for California Dairy Operators" presented by the University of California Cooperative Extension in cooperation with the California Farm Bureau, Milk Producers Council, and Western United Dairymen. For more information about the water quality programs that apply to confined animal facilities, contact the RWQCB dairy regulatory staff at one of the following offices:

- Sacramento (916) 255-3000
- Fresno (559) 445-5116
- Redding (916) 224-4845